tion and the construction of highways. Each locality has its own peculiarities and possibilities and must be studied independently in order to arrive at a safe working knowledge upon which to launch a new enterprise. General statements as to climate, soil, flora, and hydrographic conditions are often misleading and wholly inadequate for either business or scientific purposes, and the sooner exact data are available the sooner may we expect to see the development of the island go forward by the successful establishment of new enterprises.

In recognition of these peculiar conditions and in the hope of securing for and presenting to the public fuller and more exact information relative thereto, the Chief of the Weather Bureau has just authorized some special work in the collection of all information possible, both new and old, bearing on the climatology of the island and its relation to crops, hygiene, water power, commerce, and other matters of public interest. Introductory to this work, the results of which will be published later, and more especially to that part relative to the water resources of the island, it may be well to make a few observations in regard to its topography and rainfall.

In form, the island of Porto Rico is strikingly rectangular, the greater axis lying almost exactly east and west. The average width of the island is about 35 miles, and the average length about 105 miles. The area is, therefore, about 3,670 square miles. This, of course, is exclusive of the smaller dependent islands such as Vieques, Culebra, and others. The orography of the island constitutes its most striking and important characteristic. The mountains are not very high, but almost the entire surface of the island is covered with mountain peaks of varying heights and shapes, apparently without order or system as to arrangement. In places these mountains meet the sea with such abruptness that there is not room for even a driveway between mountain and sea, and in no place is there a marginal coast of considerable breadth. Notwithstanding this apparently confused and indiscriminate arrangement of the mountains, there is indeed a well-defined watershed dividing the island into two unequal portions. This divide extends from the southwest corner of the island eastward, closely parallel to the southern coast line and from 10 to 15 miles from it until within the vicinity of Guayama it approaches even nearer to the coast and then trends northeastward as does the coast line finally culminating in the highest peak on the island, El Yunque. This dividing ridge varies in height from 2,500 to 3,670 feet, and is made up of several sections, each having its own name. It will thus be evident that about one-third of the island is situated to the south of this divide and two-thirds to the north. The southern slope is necessarily very abrupt while the northern is more gradual. Both are broken up into innumerable hills and mountains with as many streams between, giving to the island a truly rugged aspect. It may help to a proper appreciation of the mountainous nature of the interior to know that there are in Porto Rico between 1,200 and 1,300 streams having names and of these about 30 are true rivers, many of them having magnificent waterfalls, especially those on the northern slope. Thus the island is divided hydrographically into two distinct sections: one lying to the east and south of the watershed, where the rivers are short and the velocity of their waters very great. The rivers of this section vary in length from 5 to 15 miles measured along their stream beds. The other section lies to the north and west of the divide and has longer rivers with larger basins. Here the rivers vary in length from 35 to 40 miles. These rivers are often very precipitous in their descent, especially for the first few miles below their sources where they frequently descend from 1,000 to 2,000 feet within less than 10 miles. Naturally, therefore, one would expect to find not a few magnificent waterfalls of great power and beauty. The possibilities of these falls as sources of power and for other purposes certainly merit a more thorough investigation than has heretofore been accorded them.

Porto Rico lies well within the northeast trade winds, which blow with great constancy throughout the year, and owing to the peculiar relation of the topography of the island to these winds, we find that the hydrographic divisions answer also for climatological purposes, the essential and determining causes being practically the same. Given, therefore, a thorough knowledge of the topography, one is at once in possession of a key to the peculiar distribution of the rainfall over the island. Under existing conditions, the east and north sides of the divide must receive by far the greater rainfall and the south and west sides the less. The records abundantly confirm the correctness of this statement. The heaviest rainfall in Porto Rico occurs in the neighborhood of Luquillo in the northeastern part of the island. There the annual fall amounts to about 150 inches. A fall of 100 inches or more at stations situated on or near the watershed is of common occurrence. Along the northern slope and especially near the coast the fall is much less, the average for a north coast station being about 55 inches. That portion of the island south and west of the divide receives still less rainfall. Not only so, but the fall seems to be more or less erratic, often resulting in severe droughts and rendering irrigation indispensable. It is thus seen that Porto Rico has wet and dry sides, more pronounced than its so-called "wet and dry seasons." The effect of this difference in the rainfall is at once seen by contrasting the truly tropical luxuriance of the vegetation on the north side with the barren hills and semiarid slopes on the south side. The dry stony river beds of the south side are also in marked contrast to the overflowing, bounding streams on the north side.

As above intimated, there exist in Porto Rico some interesting and seemingly valuable waterfalls. Among the best known and perhaps the most important, we may mention the following, viz;

Salto de Rio de la Plata, near Comerio; Salto Rio Blanco; Salto Morones, in Arecibo River, near Utuado; Salto Maldonado, in Arecibo River; Salto Sanchez, in Arecibo River; Salto Palmieri, in Arecibo river; and Salto Paso Palma, in Yayuya.

A franchise has just been granted for the development of the first-mentioned fall, the object being to utilize its power to operate a railroad from Catano to Ponce. Promoters are also investigating some of the other falls with a view to their development for electrical plants and other purposes. We hope soon to be able to present some details as to the size of the above-mentioned falls, their available power, and other information relative thereto of value to engineers and agriculturists.

NOTES AND EXTRACTS.

TROMHOLT'S CATALOGUE OF NORWEGIAN AURORAS.

No one has labored more faithfully to elucidate the problem of the aurora than Dr. Sophus Tromholt of Rostock, Norway, who died April 17, 1896.

Among his most important works was that done when he, in 1882–83, personally occupied a station at Koutokeino, in Finmark, Norway, in order to study the auroras observed by the Norwegian party at Bossekop, Norway, and the Finnish party at Sodan-Kyla. Tromholt was about 66 miles south of Bossekop, and 190 miles northwest of Sodan-Kyla, and observations of the auroras were made at all three stations at prearranged moments of time for the express purpose of determining their altitudes. The results of these special observations have as yet been only partially published.

In Petermann's Mittheilungen, 1892, Vol. XXXVIII, Tromholt published a preliminary report on two important works that he then had in hand, namely, a complete catalogue of the observations of auroras, as recorded by Norwegian ob-

servers since the year 1594, with special descriptions of the more important auroral displays and a general analysis of the reports. As it seemed likely that there would be a long delay in the publication of this important work, the summaries given by Tromholt in this preliminary communication were extremely welcome. My personal interest in the matter even led me to offer to supervise the publication in America of the original work, since the author had failed to find a publisher in Europe, but his early death closed our negotiations in this respect and it appears that his manuscript was subsequently given by his widow to his friend J. Fr. Schroeter for the purpose of publication in Norway, if possible. This desire has now been realized, and the publication at the joint expense of the Academy of Sciences at Christiania and the Fridtjof-Nansen Fund, as recommended by Professor Dr. Mohn, is a valuable addition to our knowledge of the aurora borealis.

This volume is a quarto of 422 pages of text besides the preface. In addition to the preface by Schroeter, there is also one prepared by Tromholt, from which we learn that he began the work of making this collection in 1879 and did not shrink from the great labor of examining general historical and archæological works, public and private libraries, and the archives of about a dozen public institutions, including the university library at Leipsic. Especial attention was given to Norwegian newspapers. In all cases the complete records of details were copied. The dates are always reckoned, as in astronomy, from noon to noon; the four subdivisions of Norway are: I, north of 68° 30′; II, between 68° 30′ and 65°; III, between 65° and 61° 30′; IV, south of 61° 30′. The total number of stations from which observations have been gathered is 216 and the total number of sources of information referred to in the catalogue is about 300.

Under the editorship of Schroeter, the material collected by Tromholt has been judiciously sifted and apparently nothing has been published that is not a distinct addition to exact knowledge. Especially must we approve of Schroeter's good judgment as an editor in restricting the publication of detailed descriptions, partly because so many are given in the publications of the International Polar Research, 1882–83, by expert physicists that nothing more would seem to be necessary; partly because there is abundant reason to think that the same aurora presents different aspects to observers a few miles apart, so that the mass of details must be useless until we understand more about the location and origin of the phenomena.

The list of auroras (Catalogue D) begins with September 27, 1594, and ends with April 22, 1878, covering 310 pages, and giving about 9 000 observations on nearly 6 000 different auroral dates. For each date is given the age of the moon, the place and time of observation, a few words of description, and a reference to the source of information. In the second section, special descriptions are given of suspected auroras, from 1550 to 1569, and of auroras proper from 1739 to 1878. In the third section, Table A gives the monthly and annual sums of the days on which auroras were observed somewhere in Norway. The auroral year, like the snow year, is reckoned from July to June, inclusive. The annual sums are then transformed into smoothed numbers by the formula $1/10\ (a + 2b + 4c + 2d + e)$. The annual sums are also given for each of the four sections into which the author subdivides the area of Norway. On page 352 these annual sums, from 1761 to 1878, are combined into one total, representing the monthly distribution of 5 891 days with auroras. This computation is given for each of the four subdivisions, as well as for all Norway. The monthly sums are also converted into comparable percentages by reduction to a uniform summation of 1 000, whence it appears that in the northernmost division of Norway the annual periodicity shows a maximum at the winter solstice, whereas in the southernmost section two maxima occur corresponding to the equinoxes. Therefore, in the northern portion of Norway the annual periodicity is of the same character as in the arctic regions generally. The annual period prevailing in the southern division of Norway is similar to that found in all middle latitudes. A combination of all the records of Tromholt for Norway, and Rubenson for Sweden, is given on pages 353–414, for the years 1722, March 4, to 1878, April 22. The study of the geographical distribution of these observations shows again a maximum in January in the northern regions, and maxima about September 21 and March 21 in the southern regions.

In the third part of the volume Schroeter has presented us with a new and complete recomputation of the preliminary discussion found among the papers of Tromholt, so that the figures differ somewhat from those published by the latter in Petermann's Mittheilungen. Especially has he omitted the attempt to investigate the apparent periodicity of the aurora due to the obscuration by the varying brightness of the moon, since such an investigation can not lead to any satisfactory result, unless the cloudiness of the sky has been recorded uniformly throughout many lunar months. For the same reason the study of the annual periodicity must be omitted, but we do not at first see why a similar argument would not hold good against the investigation of the sun-spot period which Schroeter has undertaken. Notwithstanding the imperfections of his data, Schroeter concludes that the results for Norway are in general quite parallel to those deduced by Rubenson from the observations in Sweden.

It is not likely that this great work of Tromholt's, taken in conjunction with its predecessors, exhausts all accessible European records, but it goes a long way toward preparing for a renewal of the comprehensive studies of the geographical and chronological distribution of auroras that were initiated by Fritz fifty years ago.—*C. A.*

MARYLAND CLIMATOLOGY.

Dr. O. L. Fassig communicates to the Library of the Weather Bureau copies of the short paper on the climate of Cecil County, Md., just now published as a part of the volume of the Maryland Geological Survey on the Geology of Cecil County. A third pamphlet on the climate of Garrett County is now in press. A similar report on Allegheny County was published in 1900. The plan is to take up each county of the State in turn and tabulate and discuss all the meteorological observations that have been made at any time in the history of the county, but especially those made under the auspices of the Smithsonian Institution, 1848–1873, the Weather Bureau, 1870–1902, and the Maryland State Weather Service, 1896–1902. The expense of publication is met by the Maryland Geological Survey. Each climatic sketch forms a chapter in the volume on the geology of the respective counties, In this way the local peculiarities of each portion of the State will be thoroughly presented.

Cecil County is in the extreme northeast section of the State of Maryland. Its surface is most gently undulating with a general elevation of about 300 feet, but occasionally rising to 500. The tide waters of Chesapeake Bay penetrate every portion of the southern part of the county. The principal records discussed in this pamphlet are those of Woodlawn from 1865 to 1875, inclusive, at which station the maximum temperature of 100° occurred once, in July, 1868, and the minimum temperature of —10°, also once, in January, 1873. The maximum monthly precipitation was 11.81, in August, 1874, and minimum monthly was 0.36, in October, 1875.—*C. A.*

WEATHER BUREAU MEN AS INSTRUCTORS.

Mr. J. R. Weeks, Observer, United States Weather Bureau, Macon, Ga., reports that he gave an informal lecture on the